

air is directed against the flame from the inside and outside. The flame is in a thin film, as in a bat's-wing burner; it is in an extended surface—that is what is necessary. The more rapidly the mixture is effected, the more certainly the chemical union will take place. There must be a mechanical mixture before there can be a chemical union. In Mr. Billingsley's plan, the vertical apertures have the effect of a number of small holes joined together, as in a bat's-wing burner. Have made experiments to ascertain the comparative expense of fuel under different systems, and will lay some of them before the committee. The quantity of water evaporated is the most fallacious test; it is no test of the heating quality of the coal. Mr. Billingsley's suggestion of the bridge but remedies a defect in the mode of introducing the air; without it, a quantity of air would pass along the bottom of the boiler, and lower its temperature. The effect of the bridge is to assist the mechanical mixture. Air admitted in that way decreases the heat on the bottom of the boiler, but creates an increase of heat along the flues. Have tried that description of bridge in many ways. By opening the door, air is admitted in front, and there is a reduction of temperature, as indicated by the pyrometer. By opening the door, the air is admitted in a body, and the temperature is reduced; if admitted in thin films, it does no harm. The primary law of combustion is, that no more air should be admitted in any one place than will unite mechanically and chemically with the gas with which it first comes into contact. When too much air passes up through the bars, there is a great increase of carbonic oxide, which then goes off unconsumed, with a great waste of heating power. Weight for weight, the greatest quantity of heat is from the gas. The simple principle of preventing smoke is, admitting air to the gas before it comes to the state of flame. The old principle is the depending on the supply passing up through the bars. Combustion is the act of chemical union between gas and the air. Introducing air in one mode may produce a cooling effect; properly introduced, it will produce a heating effect. It is impossible to say, upon an average, what is the saving of fuel; it depends on such a variety of circumstances, it is impossible to have any fixed amount of saving. The very state of the atmosphere will make a considerable difference. The idea of any fixed amount of saving is delusive; there is no foundation for such calculation. In even ill-constructed furnaces there may be a considerable saving effected. In frosty weather, when the air is drier and colder, the combustion is more perfect, for there is then more oxygen in any given bulk of air. If you could increase the heat of the air without increasing its bulk, there would be a great advantage in hot air, but that is an impossibility. The witness observed, that in a puddling-furnace, if air is admitted before it comes to that part where the melting takes place, there would be an accession of heat. In beginning his experiments, and until he had ascertained all that belonged to the generation of heat, he rejected the boiler, and experimented with the furnace alone. Much colourless gas escapes by the chimney. That was the great source of error, from the time of Watt to this day; the inflammable gases were converted into colourless carbonic oxide, which escaped unconsumed, and caused much waste. Nature has but one way of working, and the largest saving will be effected by whatever plan produces, most rapidly, a mechanical admixture of the combustible and the supporter of combustion. If the air is admitted in such a way that the gas is not of sufficiently high temperature before it passes to the flue, it will not ignite at all. The carbonic acid, in passing through the incandescent fuel on the bars, is converted into carbonic oxide."

(To be continued.)

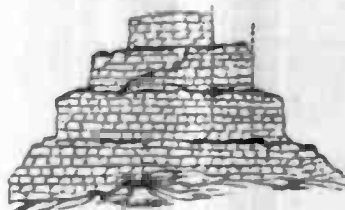
WESTMINSTER BRIDGE.—In consequence of a material sinking of the bridge, it has been determined to remove a great portion of the wall and the heavy balustrades, together with the covered stone recesses on each side, and to substitute a low or breast-high wall similar to that recently adopted at Blackfriars-bridge. The road and footpaths will also be reduced, the steep inclination at each end rendering such an improvement imperatively necessary.

THE EGYPTIAN SOCIETY.

We read in the *Athenaeum* an account of a monthly meeting of the Egyptian Society, held at Cairo in the month of July, at which Dr. Lepsius gave an account of the researches made by the Prussian expedition.

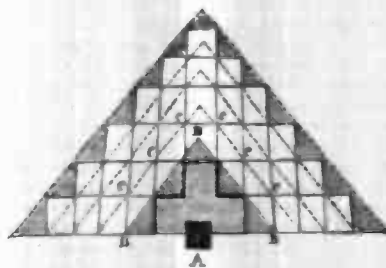
Mr. E. W. Lane being unanimously called to the chair, Dr. Lepsius commenced by stating that he felt it to be his duty, whenever he had the opportunity of visiting Cairo, to communicate any information that he might consider interesting to so useful and liberal a society. He felt assured, from the great progress already made in the few years since its establishment, that it was destined to fill an important place in the history of scientific research in this country. The Doctor then alluded, in proof, to the valuable memoir lately published by the society, contributed by M. Linant "Sur le Lac Moëris." He offered some observations on the mode of constructing the pyramids, and enumerated the many theories that had been advanced concerning the objects and the construction of these vast monuments. He, however, considered the fact established, that their object was simply to mark the places of tombs, and he then proceeded to explain to the meeting the manner in which they were constructed.

The great pyramids of Gizeh are (in comparison with many others) in a good state of preservation. From the largest, little besides the casing stones have been removed. In the second pyramid a part of the casing yet remains. In these it is impossible to see the interior construction of the stone work. But some of the small ruined pyramids at Gizeh consist of several steps, each of several courses of stone-work in height, instead of the usual form of four sides regularly converging to an apex; and in the more ruined parts of these pyramids it is seen that the steps are formed by walls built against each other, as shown by the dotted lines in the following sketch.



The masonry of the pyramids of Abousir and Sacchara is very inferior to that of the pyramids of Gizeh—in all of these the step construction is clearly seen, and also that the steps are separate walls built against each other. The pyramid at Merdoun, again, exhibits this mode of construction. In its present form it rather resembles a huge square tower, the walls of which are slightly inclined, than a pyramid: the outer layers having been mostly removed, the core or central part is left standing alone. In short, in the examination of a great number of pyramids, from Gizeh to the Fayoom, the same mode of construction was found.

To explain a mode of building apparently so contrary to sound masonry, we must suppose a chamber A for the tomb, in or under the small pyramid B B B, built over it: by filling



up the angles of the steps, and adding the fine smooth casing stone, this small pyramid would be completed; but if it were desired to enlarge the work, instead of filling up the angles to prepare for the casing, another step, of the same height and depth as the first, being added to each step of the first-mentioned pyramid, the outline touching the exterior angles of these steps, c c c, &c. would be parallel to the outline of the first pyramid; and so on, by continually adding steps of the same section,

the pyramid would be increased to any size. The foregoing sketch thus shows five pyramids, one within the other. Dr. Lepsius stated that he was indebted to Mr. J. Wild, architect, for this suggestion, and it agrees with and explains the account given by Herodotus, who states that machines were placed upon the steps, and the stones raised from one step to another. The Doctor then explained, in confirmation of his views, the remarkable pyramid of Dashour; he considered the obtuse angle of the upper part, as the original angle intended. Moreover, Dr. Lepsius observed that this mode of proceeding is in harmony with that adopted by the Egyptians in their tombs excavated in the rock. It is found at Thebes that the first care of the reigning king was to excavate in the rock, and complete and decorate a chamber for his tomb. If his life continued after the end of this labour, another chamber was added, and then another, and so on; and it is found that the largest tombs are those built by the kings who have reigned the longest. In the same manner, the pyramids may have been continually enlarged during the lifetime of the kings for whom they were intended. All the evidence that remains shows that the largest pyramids were of kings who reigned a long time. It must be remembered, that among the Egyptians it was the duty of the individual to provide a tomb for himself; his successor was immediately occupied upon his own, and thus we find many tombs either hastily or imperfectly finished, and chambers left in all states of progress. Could a monument of such stupendous size as the great pyramid of Gizeh have been contemplated as an original plan, to have been finished, or nearly so, in the lifetime of one man? but it is easy to conceive that by perpetual additions during a long reign, such a building may have been completed.

Dr. Lepsius then exhibited a selection of beautifully-finished drawings, of the subjects and inscriptions decorating the tombs round the pyramids of Gizeh and Sacchara, architectural plans, sections, &c. The time allowed was too short for more than a slight examination of them. The explanations given of some of the subjects were very interesting.

WOLFF'S PENCILS.

We recollect the nuisance and inconvenience we were subject to in our early days in preparing pencils for the bow-leg of our compasses, and for the small bow instruments; and hundreds of our readers will be reminded of similar cause of provocation. Cutting down a large pencil and wasting the lead, with, after all, a clumsy, hatching job, were the conditions under which we too frequently worked; but now, and it is a surprise it has never been thought of before, we have pencils prepared of all gauges and sizes for the purpose—and of a quality suited to the fineness of point required. Another advantage is, that the pencils are just of the length to be inserted without waste, and being leaded at both ends, with the blank of wood in the middle, can be cut across so as to supply two suitable-sized pencils in every case. There is another kind, the half-round pencil for the spring bow, manufactured with great care, for which we are also indebted to Messrs. Wolff's ingenuity and careful attention; and we can most satisfactorily recommend these articles to our readers.

NEW AND IMPROVED IRON ROOF.—At the cotton manufactory of Messrs. Garnett and Co., at Liverpool, a fire-proof roof is being erected, composed of cast and wrought iron, which for lightness and elegance of appearance, combining strength and solidity, is perhaps unrivalled. The building, which is intended for the storage of cotton, is 150 feet long by 64 feet wide, the span of the principals being equal to the latter, as there are no central supports. These principals are formed of four pieces, locking into each other, and fastened with bolts and nuts, together weighing three and a half tons; they are handsomely moulded and perforated, forming a flattish elliptical arch below, and the usual straight pitch for the roof above. When the whole is securely bolted and tied together, it will be capable of sustaining a much greater weight than it will have to bear, and goods may be stowed up to the very eaves; the laths for the slates are of wrought-iron secured edgewise, to give greater strength, while the whole is fire-proof. The splendid castings are from the Sobo Foundry, belonging to Mr. John Clayton, Preston.